# Some Concerns About the NGA-East GMM's
# --or--
# Don't Forget About the Science

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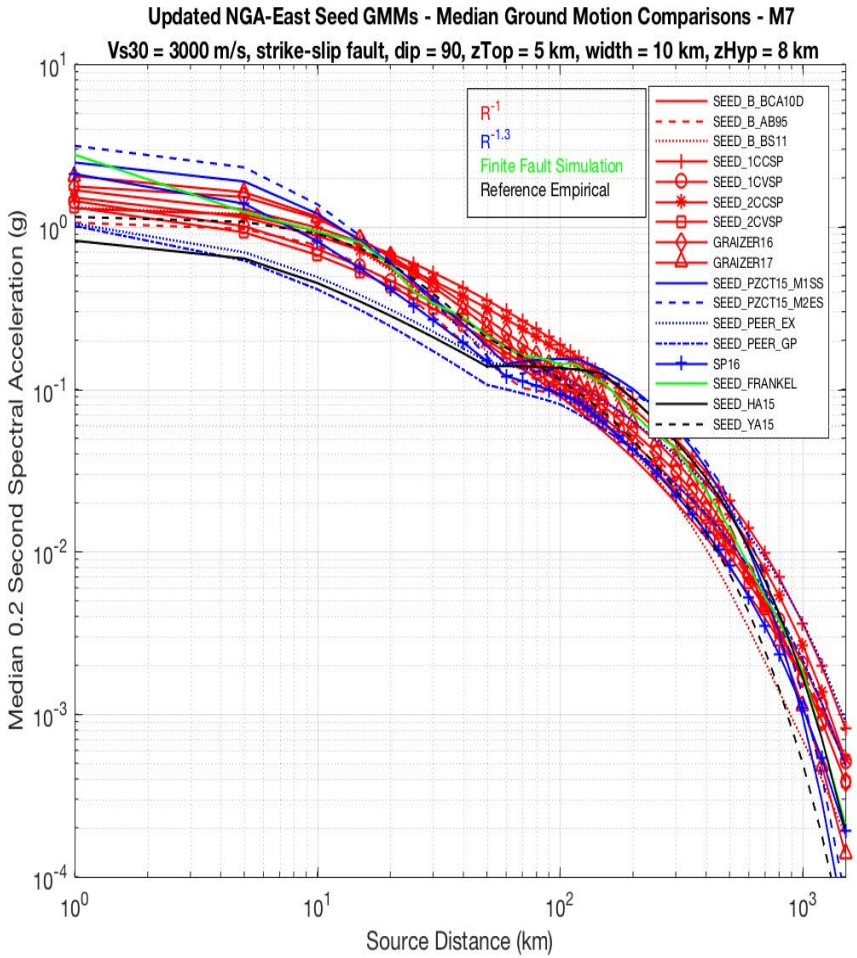
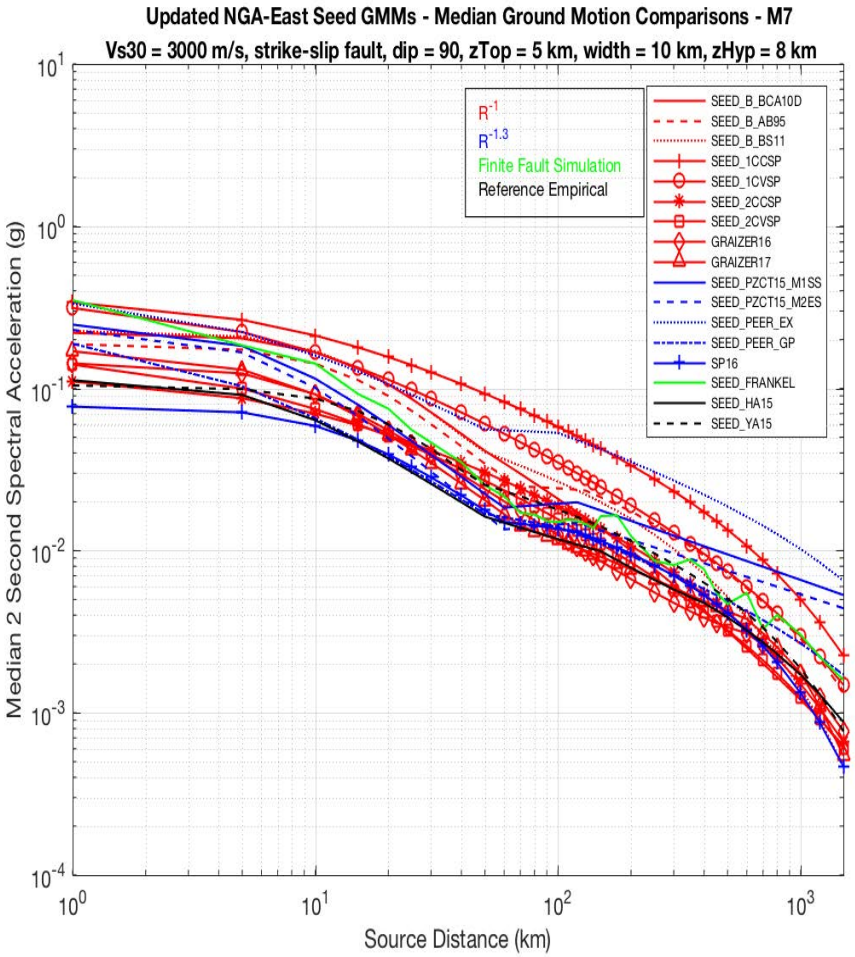
U.S. Geological Survey

Figures provided by A. Shumway and M. Petersen

# Updated NGA-East Seed Ground Motions (Logic Tree #2)




Note flat portions from Moho reflections

Note differences in geometrical spreading for distances ≤ 70 km

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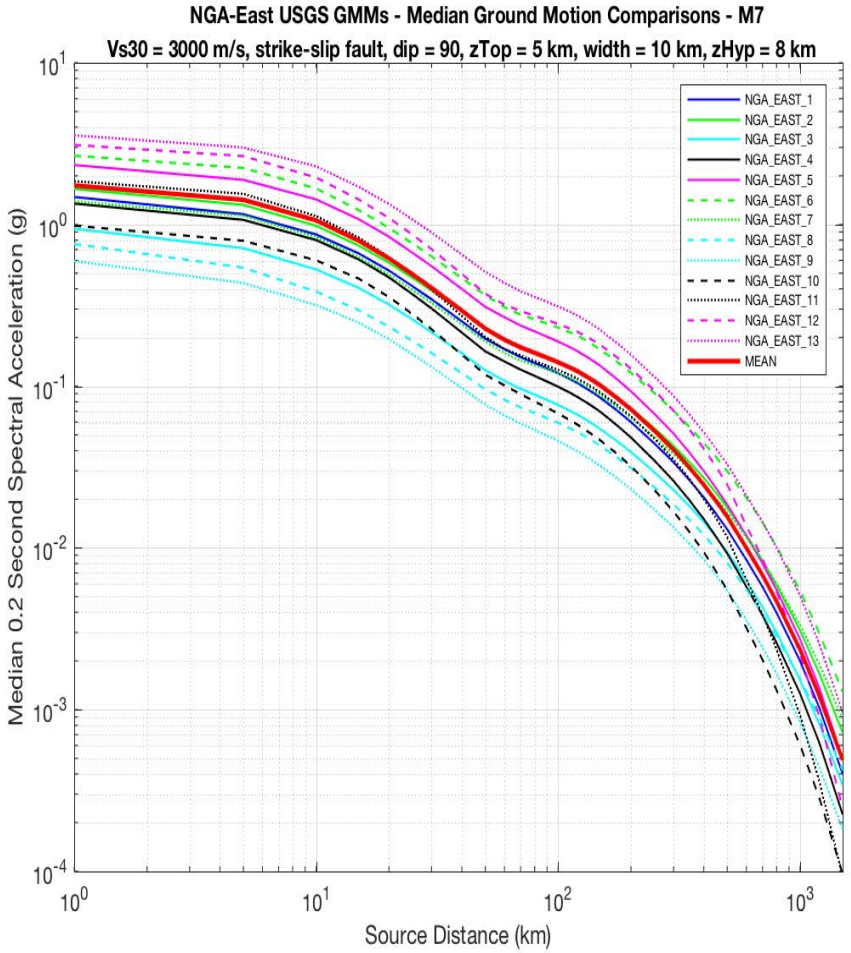
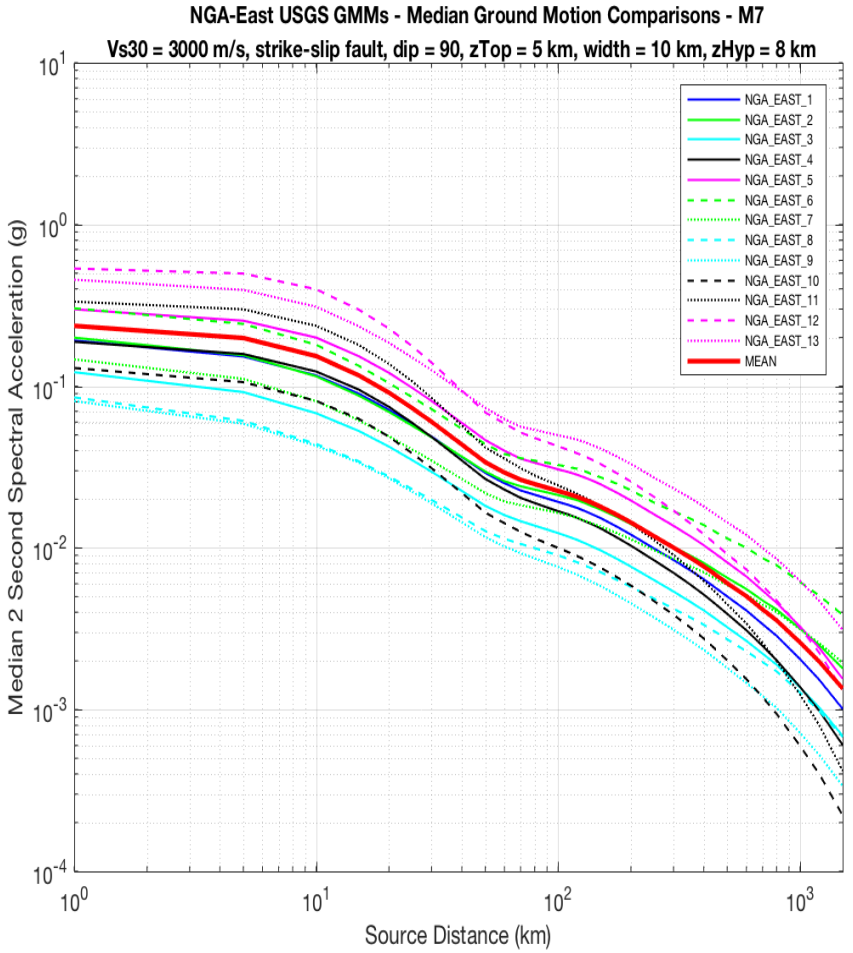
# NGA-East USGS GMMs




Don’t see differences in inflection corresponding to uncertainties in Moho reflection

No models with flat portion for Moho reflections

Don’t see differences in geometrical spreading for distances ≤ 70 km (0.2 s SA)

A high model at one distance is often high at all other distances; unlike physical models

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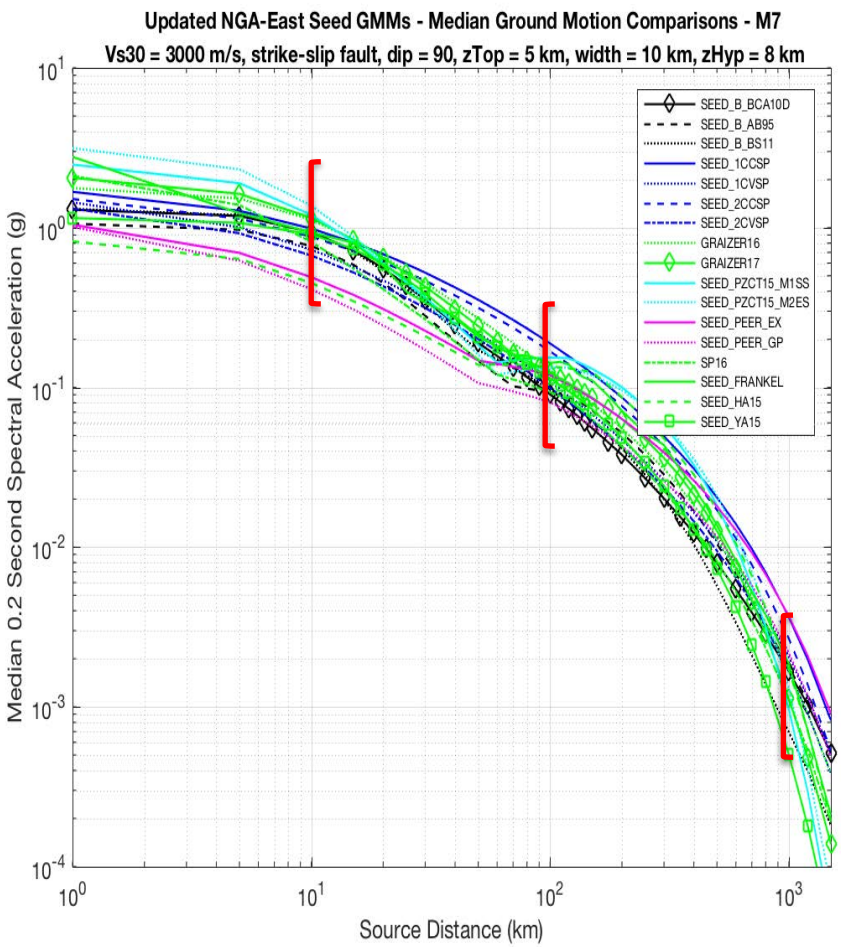
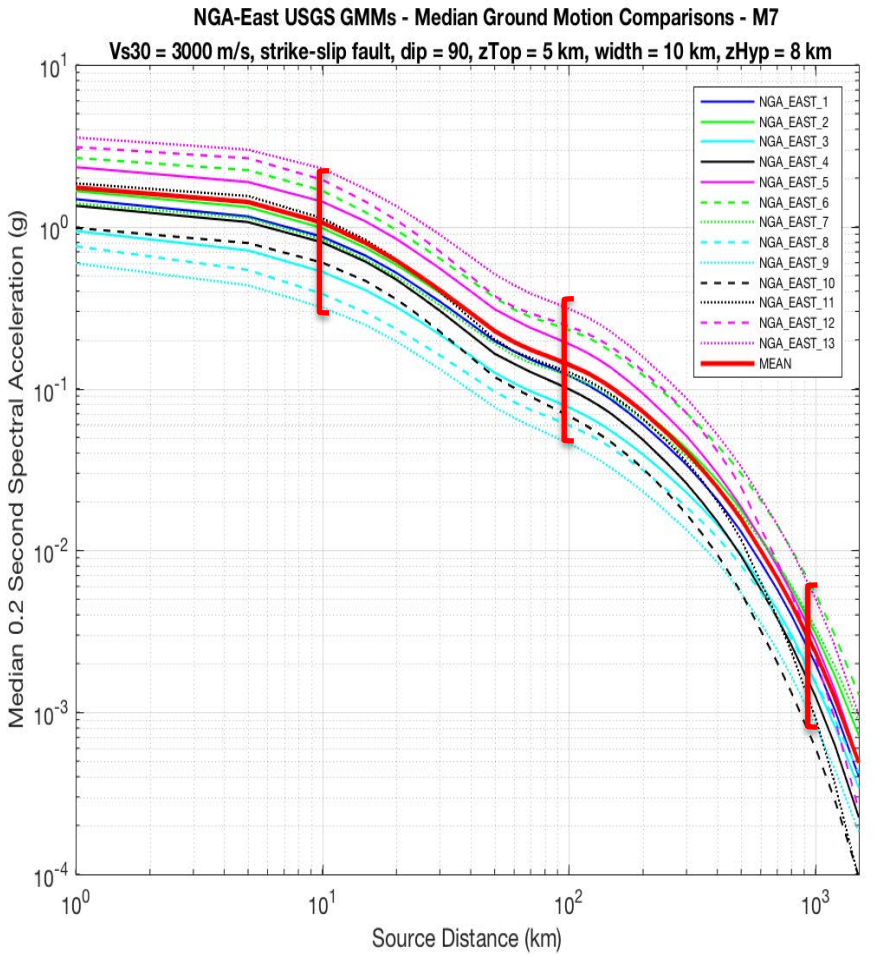
# Comparing 0.2 s GMMs

Seed models




NGA East




Note that epistemic uncertainty increases with distance for seed models, as expected from uncertainties in geometrical spreading and Moho reflections.

Epistemic uncertainty does not increase with distance for NGA-East models

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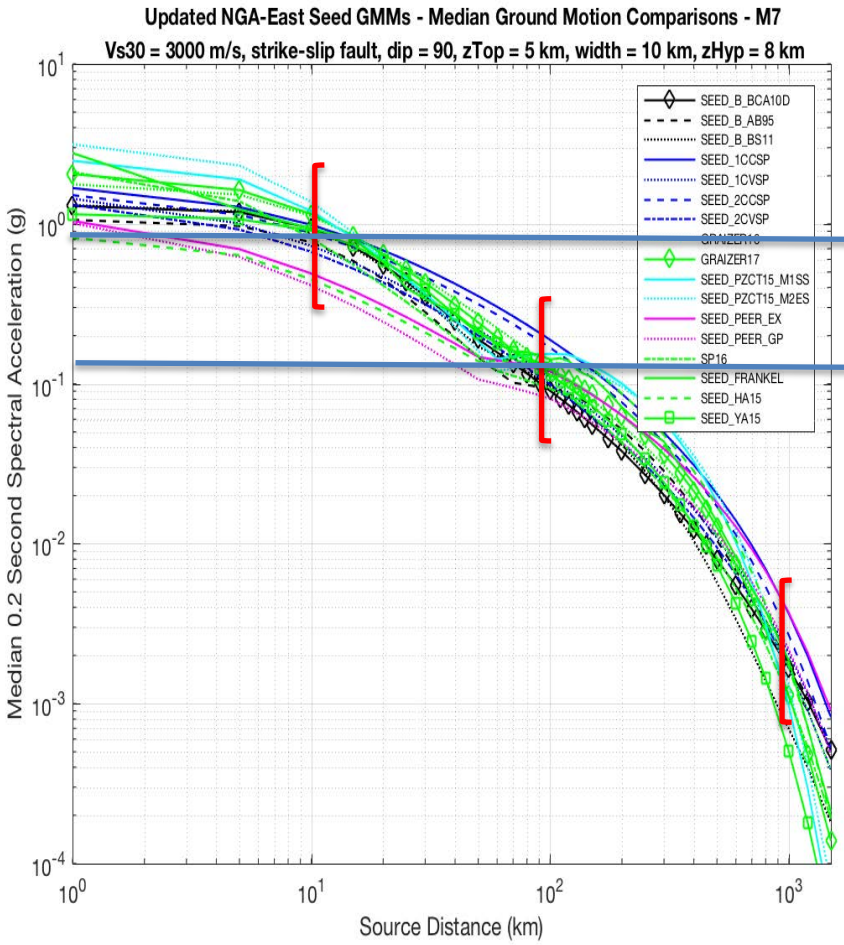
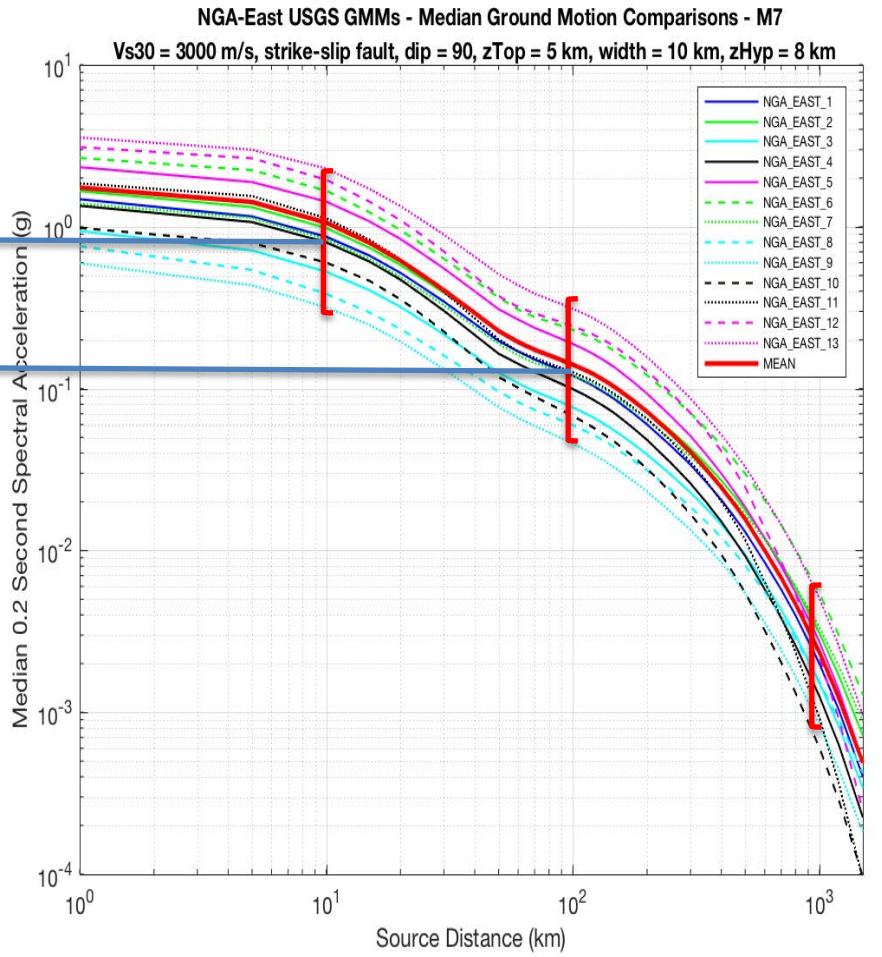
# Comparing 0.2 s GMMs

Seed models




NGA East

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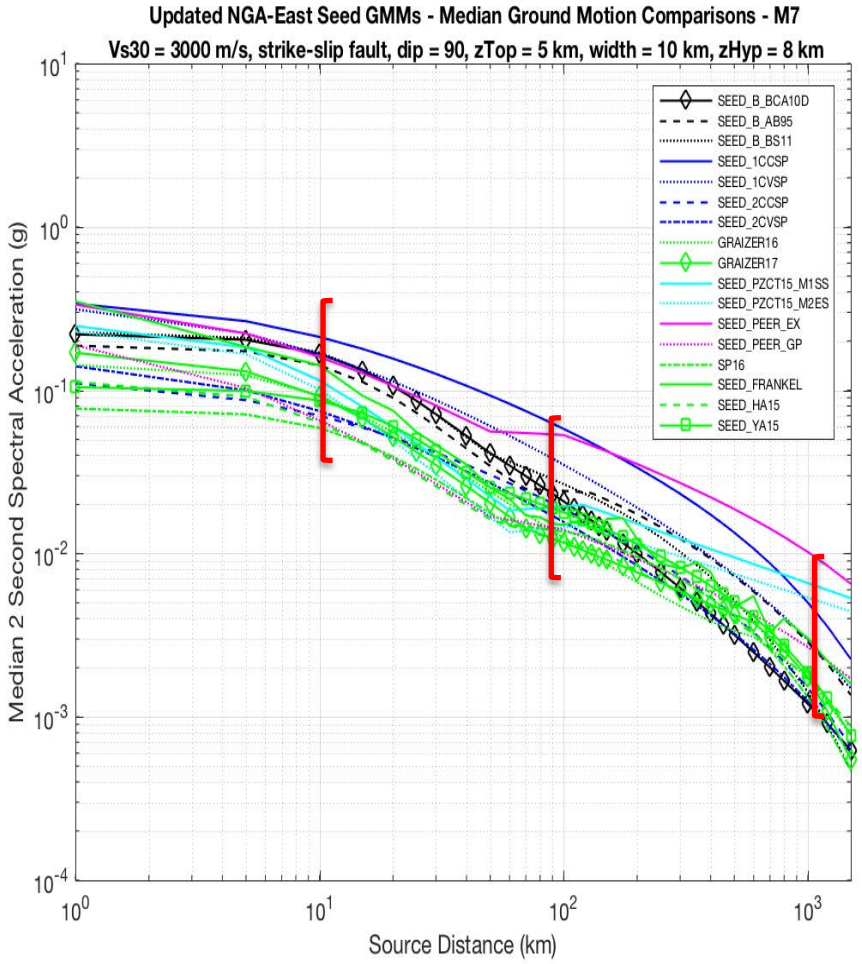
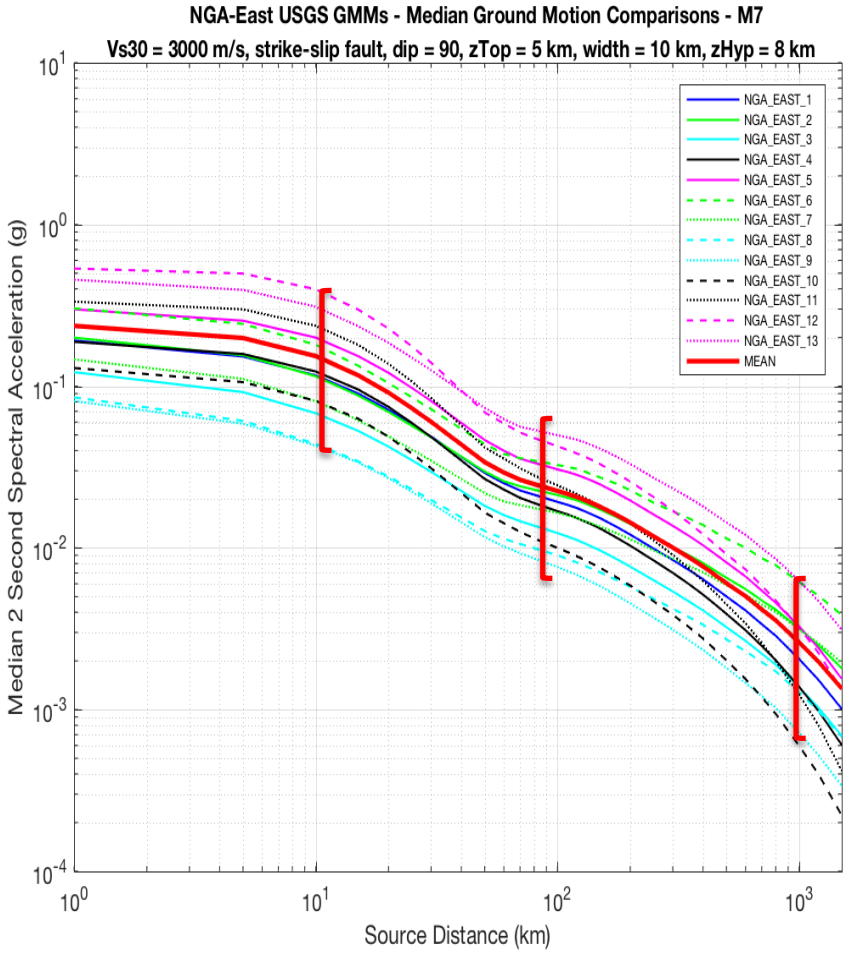
# Comparing 2 s GMM's

## Seed models




## NGA East

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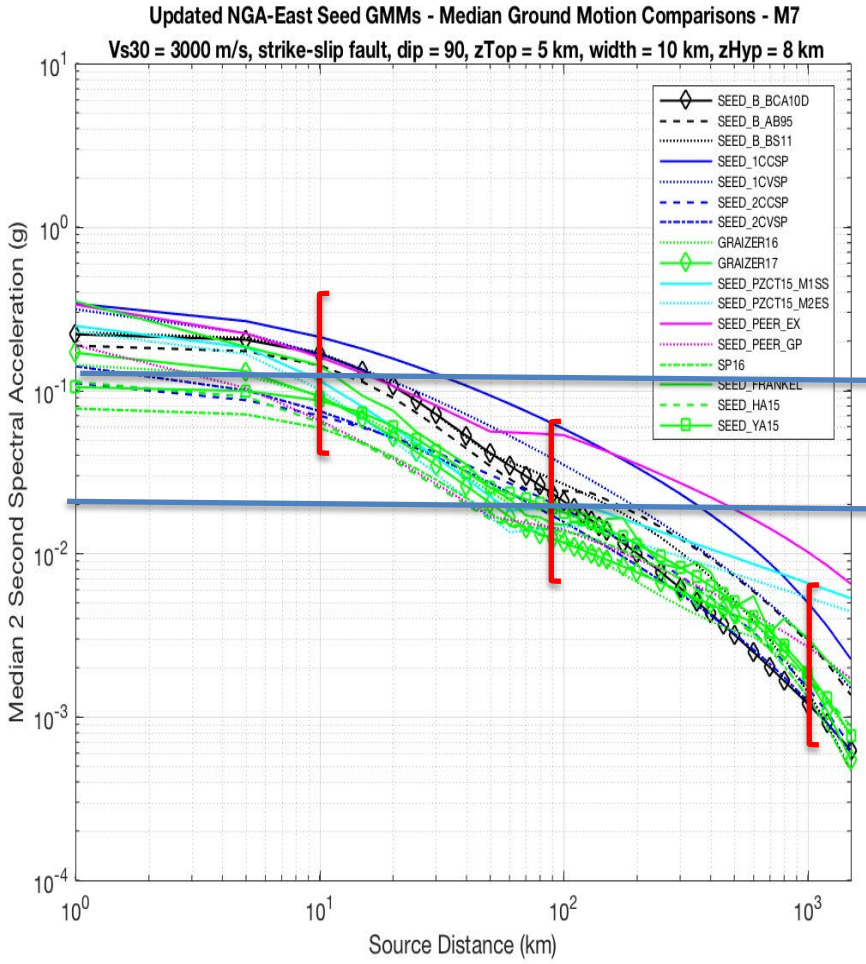
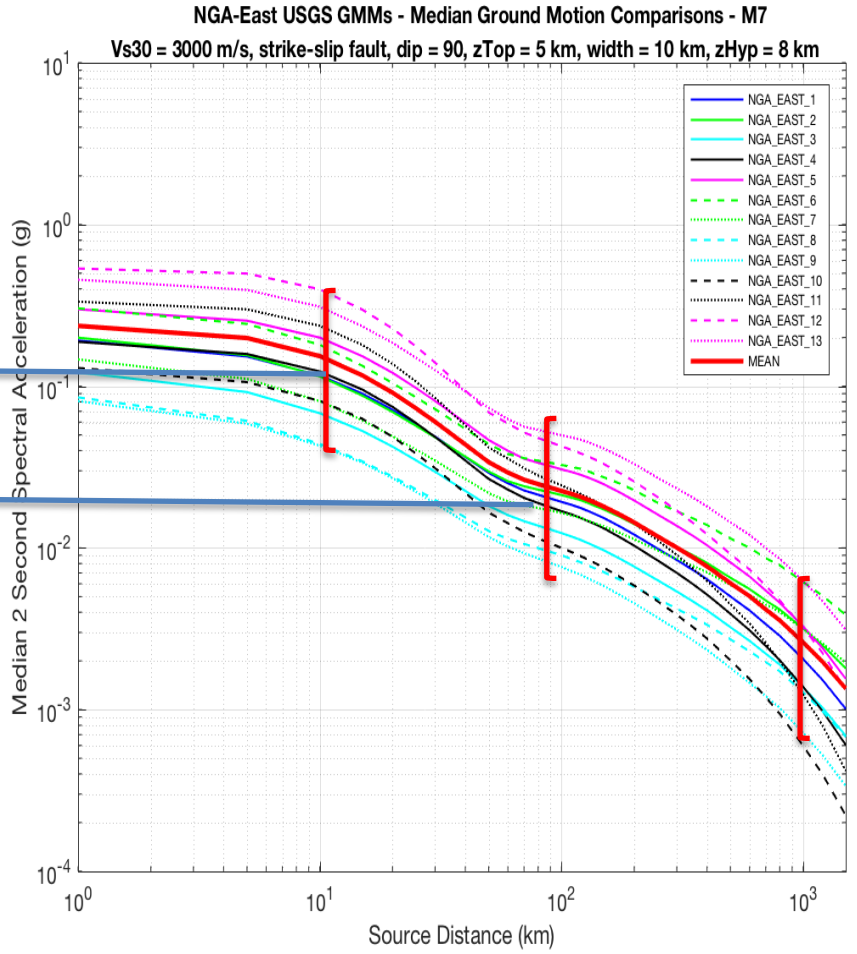
# Comparing 2 s GMM's

Seed models




NGA East

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- NGA-East randomizes the ground-motion values from physically-derived “seed” models to create a new set of GMMs. Have we lost key features of these physically-derived models?
- NGA-East GMMs appear to be similar to a backbone approach; these GMMs have little variation in distance decay
- Should epistemic uncertainty increase at 70 km because of differences in geometrical spreading ($R^{-1}$ vs. $R^{-1.3}$)?
- Should there be larger epistemic uncertainty at 70-130 km because of differences in how the Moho reflection is treated?
- Should there be larger epistemic uncertainty at 1000 km due to regional variations in Q?
- How well do the medians of the NGA-east GMMs follow those of the set of seed models?

# NGA-East USGS GMMs (13 Models)

What do these sectors on the Sammon's map mean?

Sammon's mapping is an opaque process difficult to understand and to explain

Are some sectors unphysical?

If you want to determine full epistemic uncertainty, then vary stress drop, geometrical spreading, Moho reflection, and Q for the seed models.

A short-term solution would be to add epistemic uncertainty to seed models by varying median stress drop (distance-independent shift of SA's)

- Weights for each model come from Sammon's mapping.
- Weights are period and magnitude dependent.

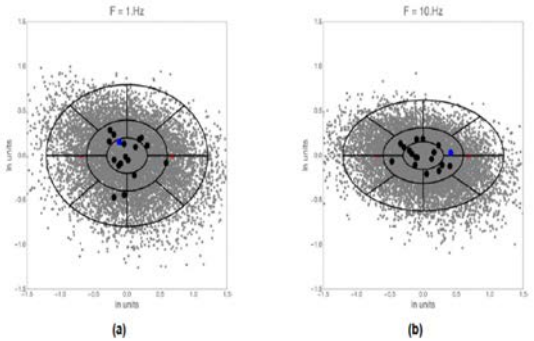



Figure 3.52 Sammon's maps for two different frequencies and 10,000 sampled models (gray points). The partition of the ground-motion space defined by the Project Team are shown as black cells. The mean model is plotted as a red dot, the up/down-scaled models are plotted as + and –, respectively. The seed models are plotted as black dots. The reference model "SP15" is plotted as a blue dot.

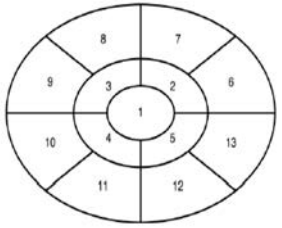
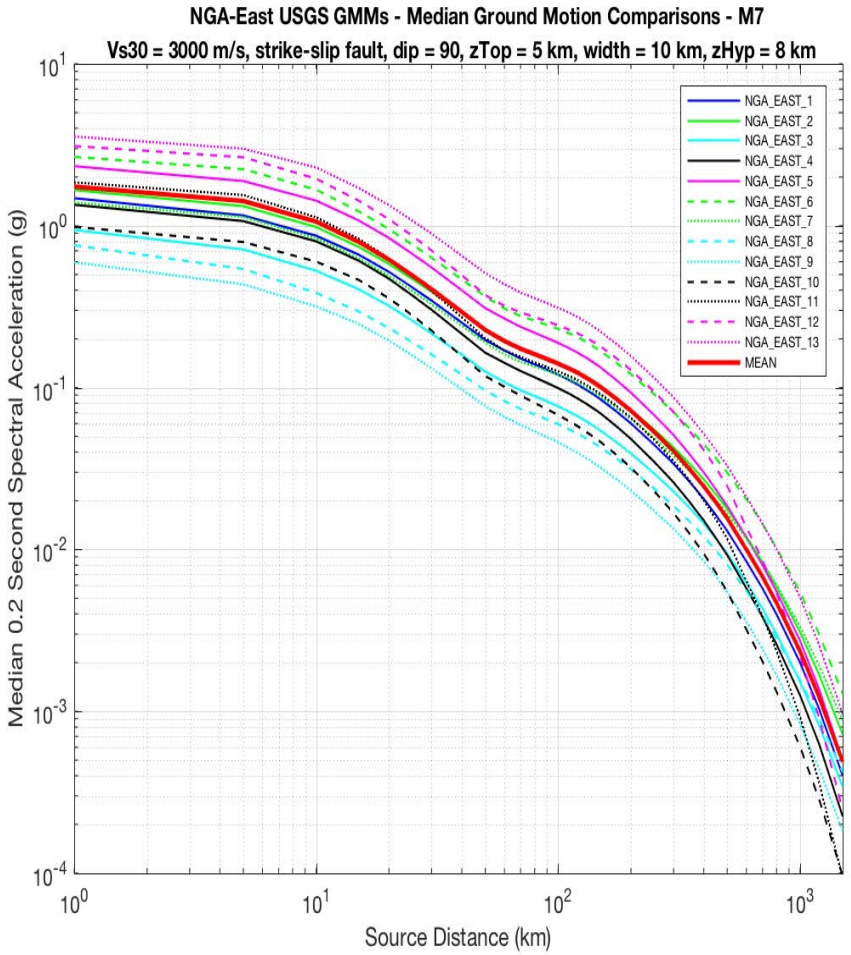
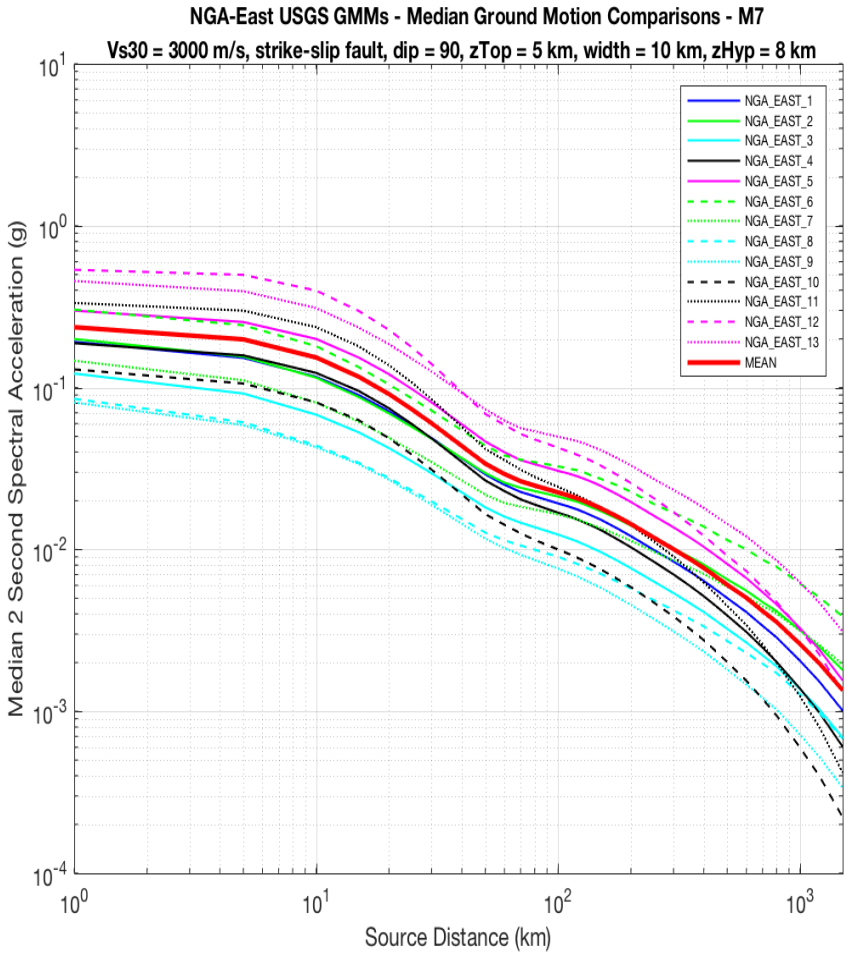



Figure 3.53 Cell index numbers.

Figure from NGA-East project

# NGA-East USGS GMMs




What does it mean when we say 84$^{th}$ percentile hazard? 84% of what models?

It matters that ground motion amplitudes are correlated between distances by physical models. If you just use the center of mass and range for each distance, you are ignoring these correlations and possibly misestimating the confidence limits of the hazard estimates.

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